

What is claimed:

1. A preferential oxidation catalyst for the oxidation of carbon monoxide to carbon dioxide in the presence of excess hydrogen, comprising:
 - at least 50 wt.% of an oxide support selected from the group consisting of activated alumina, zirconia, titania, silica, zeolites and combinations thereof;
 - 5 wt.% or more copper or an oxide thereof dispersed on the oxide support;
 - 0.01 to 0.5 wt.% of a platinum group metal selected from the group consisting of platinum, palladium, rhodium, osmium, iridium, ruthenium and combinations thereof dispersed on the oxide support; and
 - at least 10 wt.% of a reducible metal oxide selected from the group consisting of oxides of chromium, vanadium, molybdenum, cerium, praseodymium, neodymium, titanium, nickel, manganese, cobalt, and combinations thereof dispersed on the oxide support.
2. The preferential oxidation catalyst of claim 1, wherein the platinum group metal comprises platinum.
3. The preferential oxidation catalyst of claim 1, wherein the oxide support comprises activated alumina.
4. The preferential oxidation catalyst of claim 1, wherein the reducible metal oxide comprises cerium oxide.
5. A preferential oxidation catalyst for the oxidation of carbon monoxide to carbon dioxide in the presence of excess hydrogen, comprising:
 - at least 50 wt.% of an alumina support ;
 - 5 wt.% or more copper or an oxide thereof dispersed on the alumina support;
 - 0.01 to 0.5 wt.% of a platinum group metal selected from the group consisting of platinum, palladium, rhodium, osmium, iridium, ruthenium and combinations thereof dispersed on the alumina support; and
 - at least 10 wt.% of cerium oxide dispersed on the alumina support.

6. The preferential oxidation catalyst of claim 5, wherein the platinum group metal comprises platinum.
7. The preferential oxidation catalyst of claim 6, wherein there is:
 - at least 65 wt.% of the alumina support;
 - 5 to 14 wt.% of copper or an oxide thereof dispersed on the alumina support;
 - 0.01 to 0.5 wt.% of platinum in the alumina support; and
 - 10 to 25 wt.% of cerium oxide dispersed on the alumina support.
8. The preferential oxidation catalyst of claim 5, wherein the alumina support is in the form of support particles having a mesh size of 12 or greater, and a BET surface area of 10 m²/g or greater.
9. The preferential oxidation catalyst of claim 5, wherein the preferential oxidation catalyst is in the form of a washcoat composition deposited on a monolith substrate.
10. A preferential oxidation catalyst for the oxidation of carbon monoxide to carbon dioxide in the presence of excess hydrogen, comprising:
 - a cerium oxide support;
 - copper or an oxide thereof dispersed on the cerium oxide support; and
 - 0.2 wt.% or more of a platinum group metal selected from the group consisting of platinum, palladium, rhodium, osmium, iridium, ruthenium and combinations thereof dispersed on the cerium oxide support.
11. The preferential oxidation catalyst of claim 10, wherein the platinum group metal comprises platinum.
12. The preferential oxidation catalyst of claim 11, wherein there is:
 - 5 to 14 wt.% of copper or an oxide thereof dispersed on the cerium oxide support;
 - and
 - 0.2 to 5 wt. % platinum dispersed on the cerium oxide support.

13. The preferential oxidation catalyst of claim 10, wherein the preferential oxidation catalyst is in the form of a washcoat composition deposited on a monolith substrate.
14. The preferential oxidation catalyst of claim 13, further comprising a binder.
15. An apparatus for supplying hydrogen to a PEM fuel cell, wherein the apparatus has a hydrocarbon reformer reactor, a water-gas shift reactor, a preferential oxidation reactor having a preferential oxidation catalyst, wherein the preferential oxidation catalyst comprises:
 - at least 50 wt.% of an alumina support;
 - 5 wt.% or more copper or an oxide thereof dispersed on the alumina support;
 - 0.01 to 0.5 wt.% of a platinum group metal selected from the group consisting of platinum, palladium, rhodium, osmium, iridium, ruthenium and combinations thereof dispersed on the alumina support; andat least 10 wt.% cerium oxide dispersed on the alumina support;
wherein the hydrocarbon reformer reactor is upstream and in train with the water-gas shift reactor, and the preferential oxidation catalyst is downstream and in train with the water-gas shift reactor.
16. An apparatus for supplying hydrogen to a PEM fuel cell, wherein the apparatus has a hydrocarbon reformer reactor, a water-gas shift reactor, a preferential oxidation reactor having a selective oxidation catalyst, wherein the preferential oxidation catalyst comprises:
 - a cerium oxide support;
 - copper or an oxide thereof dispersed on the cerium oxide support; and
 - 0.2 wt.% or more of a platinum group metal selected from the group consisting of platinum, palladium, rhodium, osmium, iridium, ruthenium and combinations thereof dispersed on the cerium oxide support;wherein the hydrocarbon reformer reactor is upstream and in train with the water-gas shift reactor, and the preferential oxidation catalyst is downstream and in train with the water-gas shift reactor.

17. An article for selectively oxidizing carbon monoxide in a gas stream comprising carbon monoxide and hydrogen, the article comprising:
- an upstream preferential oxidation catalyst; and
 - a downstream preferential oxidation catalyst in fluid connection with the first preferential oxidation catalyst, wherein the downstream preferential oxidation catalyst comprises:
 - at least 50 wt.% of an alumina support;
 - 5 wt.% or more copper or an oxide thereof dispersed on the alumina support;
 - 0.01 to 0.5 wt.% of a platinum group metal selected from the group consisting of platinum, palladium, rhodium, osmium, iridium, ruthenium and combinations thereof dispersed on the alumina support;
 - and
 - at least 10 wt.% cerium oxide dispersed on the alumina support.
18. The article of claim 17, wherein the platinum group metal of the downstream preferential oxidation catalyst comprises platinum.
19. An article for selectively oxidizing carbon monoxide in a gas stream comprising carbon monoxide and hydrogen, the article comprising:
- an upstream preferential oxidation catalyst; and
 - a downstream preferential oxidation catalyst in fluid connection with the first preferential oxidation catalyst, wherein the downstream preferential oxidation catalyst comprises:
 - a cerium oxide support;
 - copper or an oxide thereof dispersed on the cerium oxide support; and
 - 0.2 wt.% or more of a platinum group metal selected from the group consisting of platinum, palladium, rhodium, osmium, iridium, ruthenium and combinations thereof dispersed on the cerium oxide support.
20. The article of claim 19, wherein the platinum group metal of the downstream preferential oxidation catalyst comprises platinum.